The amendment to claims 1 and 19 is in conformance with the disclosure in the originally filed application, such as at page 4, beginning at the penultimate line, continuing through the top of page 5, and originally submitted claims 2 and 3. Applicant respectfully submits that this amendment does not constitute new matter.

Moreover, entry of this amendment after final rejection is appropriate, because the amendment reduces issues for appeal while advancing the application to allowance. Still further, the amendment includes information previously considered by the Examiner in examining claims 2 and 3, which claims have presently been canceled in view of the amendment to independent claim 1 from which they depend.

Reconsideration and allowance of the application are respectfully requested.

Response To Potential Claim Objection

The Final Office Action asserts that claims 7 and 13 are substantial duplicates, and indicates that there is a potential objection of claim 13 should claim 7 be found to be allowable.

In response, Applicants note that claim 7 has been amended to depend upon claim 4 instead of claim 1, whereby this potential objection should not be made upon finding claim 7 to be allowable.

Response To Rejections Based Upon Prior Art

The following rejections are set forth in the Official Action:

(a) Claims 1-4, 6, 7, 9 and 12-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kim et al. (hereinafter Kim), U.S. Patent No. 5,645,596, in view of Ogawa et al. (hereinafter "Ogawa"), U.S. Patent No. 5,030,611, Saita et al. (hereinafter "Saita"), U.S. Patent No. 5,128,169, Shimp et al. (hereinafter "Shimp"), U.S. Patent No. 5,702,677, and Modern Ceramic Engineering (David W. Richerson, "Modern Ceramic Engineering", Marcel Dekker, Inc. 2nd Edition, 1992, pp. 519-522).

(b) Claims 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kim , U.S. Patent No. 5,645,596, in view of Ogawa, U.S. Patent No. 5,030,611, Saita, U.S. Patent No. 5,128,169, Shimp, U.S. Patent No. 5,702,677, and Modern Ceramic Engineering, as applied to claim 1, and further in view of JP 2-225382.

In response, Applicants note that claim 1 is directed to a method of manufacturing a ceramic composite, the method comprising:

preparing at least two porous ceramic bodies to be bonded together, each of the at least two porous ceramic bodies having a bonding surface and a porosity of 15 to 70%, each of the at least two ceramic bodies being formed of a calcium phosphate-based compound, and the at least two porous ceramic bodies having a different porosity from each other;

preparing a slurry in which primary particles of a bonding ceramic are dispersed, the bonding ceramic being formed of the same material as that of each ceramic body, said slurry being synthesized by merely adding a phosphoric compound to a calcium compound slurry;

applying the slurry to the bonding surface of at least one of the ceramic bodies to be bonded; and

sintering the ceramic bodies between which the slurry has been interposed to obtain fusing and growing of the primary particles of a bonding ceramic in the slurry during the sintering and bonding of the at least two ceramic bodies together so as to provide an anchoring effect between the ceramic bodies due to a combination of the porous ceramic bodies and the bonding ceramic.

Applicants' method as recited in independent claim 19 is directed to a method of manufacturing a ceramic composite for a biocompatible material, the method comprising:

preparing at least two porous ceramic bodies to be bonded together, each of the at least two porous ceramic bodies having a bonding surface and a porosity of 15 to 70%, and the at least two porous ceramic bodies having a different porosity from each other;

preparing a slurry in which primary particles of a bonding ceramic are dispersed, said slurry containing no organic components therein for preventing elution of organic components into a human body ;

applying the slurry to the bonding surface of the at least one of the ceramic bodies to be bonded; and

sintering the ceramic bodies between which the slurry has been interposed to obtain fusing and growing of the primary particles of a bonding ceramic in the slurry during the sintering and bonding of the at least two ceramic bodies together so as to provide an anchoring effect between the ceramic bodies due to a combination of the porous ceramic bodies and the bonding ceramic.

Thus, independent claims 1 and 19 include that at least two ceramic bodies have a porosity of 15 to 70% and that the porosity of each ceramic body is different from each other. Moreover, these claims recite that an anchoring effect can be obtained between the ceramic bodies due to the combination of the porous ceramic bodies and the bonding ceramic when the ceramic bodies have been sintered. Applicants' recited methods which use the recited porous ceramic bodies and a bonding ceramic applied as a slurry which comprises primary particles of the same ceramic compound of the ceramic bodies which can enter into pores of the bonding surfaces of the ceramic bodies, enables the providing of an anchoring effect when they are sintered to obtain an enhanced bonding strength.

Further, according to the methods of the present invention, it is possible to obtain a ceramic composite composed of two or more porous ceramic bodies which are integrally bonded to each other. Also, it is possible to prevent a boundary surface (interface) from being formed between sintered ceramic bodies, so that the bonding strength of the ceramic composite can be enhanced or improved.

In contrast to the presently claimed invention, Kim discloses a vertebrae prosthesis which is made of ceramics having a dense center portion and a porous circumferential portion. The porosity of the dense center portion is defined as "less than 10% (see Kim column 4, lines 64-65). This is in contrast to the porous vertebrae prosthesis of Kim having a porosity of 20 to 55% whose production is disclosed at column 4, beginning at line 66.

Thus, the vertebrae prosthesis disclosed by Kim at column 5, beginning at line 13, which is composed of a ceramic having a dense center portion and a porous circumferential portion would

not be composed of porous ceramic bodies as recited by Applicants. In particular, the dense center portion of Kim would have a porosity less than 10%, and the porous circumferential portion would have a porosity of 20 to 50%. In contrast, according to Applicants' disclosed and claimed invention, each porous ceramic body has a porosity of 15 to 70%.

In vertebrae prostheses composed of a dense center portion having a low porosity as disclosed by Kim, the anchoring effect such as associated with the present invention cannot be obtained even if a slurry of hydroxyapatite particles prepared by a wet process is applied to the bonding surfaces of the ceramic bodies. Therefore, Kim does not teach or suggest the presently claimed invention. Moreover, any combination of Kim with the prior art of record would not arrive at Applicants' disclosed and claimed invention.

Still further, Applicants incorporate by reference their remarks regarding Kim as set forth in their previous response. For the sake of brevity, these remarks are not being repeated herein, but are included herein as if set forth in their entirety.

The remaining documents utilized in the rejections do not overcome the deficiencies of Kim. In this regard, as previously noted by Applicants, the slurry disclosed in Ogawa contains two or more ceramic materials, and therefore does not teach nor suggest that each of the at least two ceramic bodies is formed of a phosphoric compound, and that the bonding ceramic is formed of the same material as that of each ceramic body. Accordingly, Ogawa is different from Applicants' invention in that, amongst other features, Ogawa does not teach or suggest the slurry of the present invention in which the bonding ceramic is the same as the ceramic bodies and is formed of a phosphoric compound.

Moreover, Ogawa does not teach or suggest use of the slurry as a binder for bonding two or more ceramic bodies. Ogawa is directed to the formation of porous ceramic materials from slurries. Therefore, one having ordinary skill in the art would not have been motivated to modify Kim based upon the disclosure of Ogawa. In any event, even if for the sake of argument Kim and Ogawa were combined, the instantly claimed invention would not be present, because any combination of Kim and Ogawa would not arrive at Applicants' disclosed and claimed invention.

Saita is directed to a method for forming hydroxyapatite coating film on a surface of a substrate which is useful for an implant material in view of the excellent affinity of the coating film to a living body. Saita is not directed to a method of manufacturing a ceramic composite by interposing a slurry between two ceramic bodies in the manner according to Applicants' disclosed and claimed invention. One having ordinary skill in the art would not have been motivated to modify Kim based upon the disclosure of Saita.

The portion of Shimp utilized in the rejection simple states that, "Binders may interfere with the sintering process, even if organic binders which leave no mineral residue upon firing are used (col. 1, lines 40-43)". The reference to binders in Shimp appears to be directed to the use of binders in an agglomeration process for producing hydroxyapatite particles. Such disclosure does not provide any motivation for modifying a process as disclosed in Kim which is directed to the use of an apatite slurry for bonding ceramic bodies. Accordingly, one having ordinary skill in the art would not have been motivated to modify Kim based upon Shimp to arrive at Applicants' disclosed and claimed invention. Moreover, any combination of these documents would not arrive at Applicants' disclosed and claimed invention for the reasons discussed above.

Modern Ceramic Engineering is also directed to the formation of ceramic powders and sintering characteristics and, similarly to the other documents discussed above, does not provide any motivation for modifying Kim. Moreover, any combination of Kim and Modern Ceramic Engineering would not arrive at Applicants' disclosed and claimed invention.

Applicants respectfully submit that the only teaching or suggestion that would lead one having ordinary skill in the art to arrive at Applicants' invention is within Applicants' disclosure, and the use of such disclosure by the Examiner is improper. In order to support the conclusion that the claimed invention is either anticipated or rendered obvious over the prior art, the prior art must either expressly or inherently teach the claimed invention or the Examiner must present a convincing line of reasoning why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references. Ex parte Clapp, 227 U.S.P.Q. 972 (B.O.A. 1985).

Additionally, each of the dependent claims is patentable over the prior art of record in view of the fact that each of these dependent claims includes the limitations of independent claim 1. Moreover, each of the dependent claims is patentable over the prior art of record because it would not have been obvious to one having ordinary skill in the art to incorporate such dependent claim features into the invention as more broadly recited in independent claim 1.

Applicants point out that this is particularly true with respect to claim 10, which recites a method of manufacturing the ceramic composite as claimed in Claim 1, wherein the particles of the binding ceramic have an average grain size of 0.05 to 0.5 μm. Thus, claim 10 defines subject matter which is even more non-obvious than the preceding claims. By employing a bonding ceramic comprised of ceramic particles having the recited small particle size, the ceramic particles enter

pores of the ceramic bodies to be bonded, thus making it possible to bond the bonding surfaces of the ceramic bodies more firmly. As a result, a boundary surface becomes almost non-existent, if at all present, between the ceramic bodies, thereby enabling the obtaining of a ceramic composite having higher bonding strength between the ceramic bodies.

In view of the above, the rejections should be withdrawn as improper, and all of the claims should be indicated as allowable over the prior art.

CONCLUSION

The Examiner is respectfully requested to reconsider and withdraw the rejections of record, and allow each of the pending claims.

Applicants therefore respectfully request that an early indication of allowance of the application be indicated by the mailing of the Notices of Allowance and Allowability.

Should the Examiner have any questions regarding this application, the Examiner is invited to contact the undersigned at the below-listed telephone number.

Respectfully submitted,
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APPENDIX
MARKED UP COPY OF AMENDED CLAIMS 1, 7 AND 19

1. (Four Times Amended) A method of manufacturing a ceramic composite, the method comprising:

preparing at least two porous ceramic bodies to be bonded together, each of the at least two porous ceramic bodies having a bonding surface and a porosity of 15 to 70%, [and] each of the at least two ceramic bodies being formed of a calcium phosphate-based compound, and the at least two porous ceramic bodies having a different porosity from each other;

preparing a slurry in which primary particles of a bonding ceramic are dispersed, the bonding ceramic being formed of the same material as that of each ceramic body, said slurry being synthesized by merely adding a phosphoric compound to a calcium compound slurry;

applying the slurry to the bonding surface of at least one of the ceramic bodies to be bonded; and

sintering the ceramic bodies between which the slurry has been interposed to obtain fusing and growing of the primary particles of a bonding ceramic in the slurry during the sintering and bonding of the at least two ceramic bodies together so as to provide an anchoring effect between the ceramic bodies due to a combination of the porous ceramic bodies and the bonding ceramic.

7. (Twice Amended) The method of manufacturing the ceramic composite as claimed in claim [1] 4, wherein the calcium phosphate-based compounds include hydroxyapatite.

19. (Thrice Amended) A method of manufacturing a ceramic composite for a biocompatible material, the method comprising:

preparing at least two porous ceramic bodies to be bonded together, each of the at least two porous ceramic bodies having a bonding surface and a porosity of 15 to 70%, and the at least two porous ceramic bodies having a different porosity from each other;

preparing a slurry in which primary particles of a bonding ceramic are dispersed, said slurry containing no organic components therein for preventing elution of organic components into a human body ;

applying the slurry to the bonding surface of the at least one of the ceramic bodies to be bonded; and

sintering the ceramic bodies between which the slurry has been interposed to obtain fusing and growing of the primary particles of a bonding ceramic in the slurry during the sintering and bonding of the at least two ceramic bodies together so as to provide an anchoring effect between the ceramic bodies due to a combination of the porous ceramic bodies and the bonding ceramic.